

Remarks

I. Summary of Office Action

Claims 1-36 are pending in this case. Claims 1, 9, 11, 20, 27 and 29 are independent claims.

Claims 1, 9-12, 20, 21, 23, 26-29 and 36 were rejected under 35 U.S.C. § 102(e) as being anticipated by Heath, Jr. et al. U.S. Patent No. 6,298,092 ("Heath").

Claims 1, 9, 11, 12, 20, 27 and 29 were objected to for containing various informalities.

Claims 2-8, 13-19, 22, 24, 25 and 30-35 were rejected as being dependent upon a rejected base claim, but were indicated as allowable if rewritten in independent form to include all the limitations of the base claim and any intervening claims.

II. Summary of Applicants' Reply

Applicants wish to thank the Examiner for acknowledging the allowability of dependent Claims 2-8, 13-19, 22, 24, 25 and 30-35. In response, applicants have added new independent Claims 66 and 67. Claim 66 includes features similar to the features of Claims 20 and 25 as originally filed. Claim 67 includes features similar to the features of Claims 25 and 27 as originally filed. No new matter has been added. Applicants respectfully submit that new Claims 66 and 67 are allowable at least because Claim 25 is allowable. Accordingly, prompt consideration and allowance of new independent Claims 66 and 67 are accordingly respectfully requested.

Applicants have amended independent Claims 1, 9, 11, 20, 27 and 29. No new matter has been added. The 35 U.S.C. § 102 rejection is respectfully traversed.

Applicants have amended Claims 1, 9, 11, 12, 20, 27 and 29 to correct the informalities noted in the Office Action. Applicants have also amended Claims 1, 8, 9, 11, 13, 14, 20, 22, 23, 26, 28-30 not in response to any rejection, but to place these claims in better form. New dependent Claims 37-65 have been added. No new matter has been added.

Reconsideration and allowance of this application in light of the following remarks is respectfully requested.

III. 35 U.S.C. § 102 Rejection

Independent Claims 1, 9, 11, 20, 27 and 29 are directed to methods and apparatus for use with a system that transmits OFDM signals from a plurality of transmitter antennas to a plurality of receiver antennas, where at least one of the OFDM signals includes a plurality of sub-carriers. Amended independent Claims 1 and 20 include, amongst other things, that a determination is made “for a sub-carrier of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carrier.” Similarly, amended independent Claims 9 and 27 include the responding to a feedback signal, the feedback signal “indicative of a determination for a sub-carrier of the plurality of sub-carriers as to whether time diversity or spatial diversity should be used for subsequent transmission on the sub-carrier,” to assign constellation points for the time diversity or the spatial diversity to the sub-carrier. Amended independent Claims 11 and 29 include features similar to the above-described features of Claims 1, 9, 20 and 27.

In the Office Action, the Examiner contends that Heath shows all the features of applicants’ independent claims. Applicants respectfully disagree. In particular, Heath

does not disclose or suggest, *inter alia*, applicants' claimed approaches of making a determination, or responding to a feedback signal indicative of a determination, "for a sub-carrier of . . . [a] plurality of sub-carriers as to whether time diversity or spatial diversity should be used for a subsequent transmission on the sub-carrier" (emphasis added). Rather, Heath determines whether given antennas 72 (FIG. 3) will use diversity or spatial multiplexing (Heath, col. 9, ll. 10-12 and col. 9, l. 54 to col. 10, ll. 17).

The difference between applicants' claimed approach and Heath can be understood with reference to, for example, applicants' FIG. 4. As shown, transmitter antennas "Antenna_1" and "Antenna_2" transmit OFDM symbols that include a plurality of sub-carriers. In accordance with applicants' claimed approach, a determination may be made that a given sub-carrier k (S_k) should use spatial diversity for the transmission. This causes the antennas in FIG. 4 to use spatial diversity for the sub-carrier k (i.e., Antenna_1 transmits signals $S_k(1)$ and $S_k(2)$ on sub-carrier k that are independent of signals $S_k(3)$ and $S_k(4)$ transmitted by Antenna_2 on sub-carrier k) (see also p. 3, ll. 13-15 and p. 11, ll. 18-20 of applicants' specification). However, the antennas may still use, for example, either spatial diversity or time diversity for the other sub-carriers. In direct contrast, Heath does not make any determinations for individual sub-carriers. Instead, Heath determines whether given antennas should use time diversity or spatial multiplexing. Thus, assuming *arguendo* that the Heath approach could be applied to applicants' FIG. 4, a Heath determination that the FIG. 4 antennas should use spatial

diversity would cause all of the sub-carriers transmitted by the antennas to use spatial diversity.*

Thus, the foregoing demonstrates that Heath does not disclose or suggest all the features of applicants' independent Claims 1, 9, 11, 20, 27 and 29. The independent claims and corresponding dependent claims 10, 12, 21, 23, 26, 28 and 36 are therefore allowable over Heath. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the 35 U.S.C. § 102 rejection of Claims 1, 9-12, 20, 21, 23, 26-29 and 36.

IV. New Independent Claims 66 and 67

New independent Claims 66 and 67 include features similar to Claim 25 as originally filed. Particularly, Claim 66 includes that the determination as to whether time diversity or spatial diversity should be used for subsequent OFDM transmission is "based on a channel condition indicated by a criteria selected from the group of criteria consisting of an eigen value of a channel matrix, an element in a diagonal of the channel matrix and a plurality of eigen values of the channel matrix." Similarly, Claim 67 includes that an encoder assigns constellation points for time diversity or spatial diversity to at least one sub-carrier "in accordance with a channel condition . . . determined based on a criteria selected from the group of criteria consisting of an eigen value of a channel matrix, an element in a diagonal of the channel matrix and a plurality of eigen values of the channel matrix."

The Examiner acknowledges in the Office Action that dependent Claim 25 is allowable over Heath (Office Action, p. 11). However, seemingly contradictory to this

* The above example with respect to applicants' FIG. 4 is not an admission by applicants that Heath enables the use of its approach in an OFDM system. On the contrary, applicants reserve the right to demonstrate at a later stage if necessary that Heath is not so enabling.

acknowledgement, the Examiner contends that the portion of Heath at column 8, line 65 to column 9, line 5 anticipates dependent Claim 23 (Office Action, p. 7). Claim 23 includes a subset of the elements set forth in the Markush group of Claim 25, namely that the channel condition is based on the smallest element in a diagonal of the channel matrix.

Contrary to the Examiner's contention, applicants respectfully submit that the cited portion of Heath fails to disclose or suggest, *inter alia*, any of the criteria defined by the Markush group of Claim 25, much less the specific criteria defined by dependent Claim 23. The cited portion of Heath only states that "parameters computation block 104 . . . can compute channel parameters such as SINR, Frobenius norms, singular values, condition of channel coefficients matrix H and other channel parameters" (Heath, col. 8, l. 65 to col. 9, l. 5). This portion of Heath does not disclose that block 104 determines the smallest element in a diagonal of the channel matrix, nor does this portion disclose that the Heath system uses this criteria to determine the channel condition as stated by Claim 23. In fact, Heath only discloses using the criteria of a minimum Euclidian distance or a probability of error of a channel matrix to determine a channel condition (see e.g., Heath, col. 3, l. 65 to col. 4, l. 1, col. 4, ll. 41 and 42 and col. 13, ll. 1-6). Moreover, applicants respectfully submit that it would not be obvious to modify the Heath system to calculate and/or use any of the specific criteria defined by the Markush group of dependent Claim 25. In direct contrast, Heath admits that such a modification for developing additional methods and rules for selecting a channel condition "would represent a significant advance in the art" (Heath, col. 3, ll. 12-15).

Thus, the foregoing demonstrates that the features of dependent Claim 25 are allowable over Heath. Because new Claims 66 and 67 include features similar to the features of dependent Claim 25, applicants respectfully submit that new Claims 66 and 67 are allowable over Heath. Accordingly, prompt consideration and allowance of new independent Claims 66 and 67 are respectfully requested.

V. Amendments to the Claims to Correct Informalities

Applicants have amended Claims 1, 9, 11, 12, 20, 27 and 29 to correct various informalities noted by the Examiner (Office Action, p. 2). In particular, applicants have amended Claims 1, 9, 11, 20, 27 and 29 to replace “because” with --wherein-- in each instance. Applicants have amended Claim 12 to replace “controller is” with --controllers are--. No new matter has been added. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the objection to these claims.

**VI. Amendments Placing Claims in Better Form
And New Dependent Claims 37-53**

Applicants have made various additional amendments to Claims 1, 8, 9, 11, 13, 14, 20, 22, 23, 26, 28-30 not in response to any rejection, but to place these claims in better form. New dependent Claims 37-53 have been added. No new matter has been added. In particular:

Claims 1, 9, 11, 20, 27 and 29 have been amended to include “transmitter antennas,” “receiver antennas” and “OFDM data signals.” Support for these amendments can be found in the originally-filed application at, for example, page 10, line 1 to page 11, line 17, page 30, lines 7-9 and in FIGS. 2, 3 and 8.

Claims 1, 20 and 29 have been amended to correct typographical errors, namely to replace “transmits” with --transmitting--.

Claims 8, 26 and 28 have been amended to include classifying each sub-carrier of the plurality of sub-carriers into one of two groups in accordance with a respective channel condition for that sub-carrier (see e.g., applicants’ specification, p. 10, ll. 3-21). Various features from Claims 8, 26 and 28 have been deleted and rewritten as new dependent Claims 37-39, respectively.

Claims 13 and 30 have been amended to include making a determination as to which sub-carriers use time diversity and which sub-carriers use spatial diversity based on eigen values of channel matrices (see e.g., applicants’ specification, p. 10, ll. 3-14). Claim 30 has also been amended to delete an instance of the word “to.”

Claim 14 has been amended to change its dependency to claim 11 and to delete an instance of the word “so.”

Claim 23 has been amended to correct a typographical error, namely to replace “An” with --A--.

Support for new dependent Claims 40-45 can be found in the originally-filed application at, for example, page 12, lines 7-9.

Support for new dependent Claims 46 and 47 can be found in the originally-filed application in, for example, Claim 13.

Support for new dependent Claims 48-53 can be found in the originally-filed application at, for example, page 12, lines 4-7.

Support for new dependent Claims 54-65 can be found in the originally-filed application at, for example, page 9, line 19 to page 10, line 18.

VII. Contingent Request for Telephonic Interview

If for any reason the Examiner decides not to allow this application based on this Reply, applicants respectfully request a telephonic interview with the Examiner before the issuance of a final Office Action.

VIII. Conclusion

Applicants respectfully submit that the foregoing demonstrates that this application is in condition for allowance. Accordingly, prompt consideration and allowance of this application are respectfully requested.

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Respectfully submitted,



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